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INCINERATION OF GARBAGE

Incineration is the controlled burning of wastes to reduce their volume and in some cases to recover energy from the incinerated waste. On average, a municipal solid waste (MSW) incinerator leaves a residue of about one-third of the original waste. This residue, in the form of bottom and fly ash, often contains many toxic substances. In addition to garbage, different types of incinerators may be used to burn biomedical and hazardous wastes.

Ontario has five existing garbage incinerators and one approved facility nearing completion. About 400,000 tonnes per year of garbage is burned. That's nearly four per cent of all solid waste from residential, commercial, industrial and institutional sources combined. Since April, 1991, the construction of new garbage incinerators has been banned because of various environmental problems associated with incineration and their incompatibility with waste reduction programs.

INCINERATION TECHNOLOGIES

For large scale plants, handling 300 tonnes of waste a day or more, wastes are usually deposited in a storage pit where a crane grapple loads the furnace feed hopper. Small scale plants, handling less than 300 tonnes a day, generally use a large tipping floor, and a front-end loader fills the feed hopper.

Mass Burn

Mass burn incineration plants generally incinerate wastes in a one-stage operation. There is no prior processing except for the removal of large, bulky, non-combustible or explosive wastes. Some mass-fired plants can handle more than 3,000 tonnes per day. There are approximately 400 plants worldwide with a total capacity of about 200,000 tonnes per day. Mass burn systems are used in the Greater Vancouver Regional District, British Columbia, and in Quebec City.

Modular

Modular incinerators involve a two-stage operation. They have a primary chamber and a secondary chamber. Waste is placed into the primary chamber and burned. The gases produced in the primary chamber by the combustion process are then burned in the secondary chamber. This approach reduces the amount of waste gases to be controlled as compared to the one-stage mass burn process. Examples of modular units include the energy from waste (EFW) plants in Charlottetown, P.E.I., London, and Brampton, Ontario.

Semi-suspension

Semi-suspension systems consist of a furnace which allows fuel to be injected to help the burning process. These systems require shredding of materials and removal of non-combustible materials before incineration. An example is a facility in Hamilton, Ontario.

Fluid Bed

Fluid bed incineration is the combustion of wastes in a bed of material, usually sand or a mixture of sand and limestone which has been "fluidized" by the injection of heated air at the bottom of the bed. Fluidized bed incinerators are generally noted for their ability to accept a wide range of fuels or mixtures of fuels.

Pyrolysis

Pyrolysis is the process of disposing of organic garbage without using air (oxygen) but by using heat. With this type of system it is usually better to shred the waste to provide a uniform feed size for the pyrolysis reactor. Applying heat distils the waste into carbon products consisting of carbon gases and a charcoal residue. The condensable gases may be collected in a storage tank to be burned later, converted to chemical products or treated and discharged. The non-condensable gases which are not used to heat the pyrolytic reactor are normally used as a fuel for energy recovery.

Although pyrolysis systems have been built, there are no commercial facilities operating in North America. Problems have been found with fuel processing, combustion and poor quality emissions.

ENERGY FROM WASTE

Some incinerators, called energy from waste (EFW) plants, generate energy in the forms of steam, electricity and hot water. This means harnessing the escaping heat from the combustion process and channelling it into something practical such as warming a building. EFW plants burn paper, wood, vegetation, plastics, rubber and other wastes. In practice, energy recovery is often needed to try to make an incineration plant economically viable.

Plants that separate and recover material before incineration may produce waste pellets that can be sold elsewhere as a fuel. Such plants are referred to as refuse derived fuel (RDF) production plants. EFW plants can be designed to burn RDF or RDF in combination with other fuels such as coal.

ENVIRONMENTAL CONTROLS

Fabric filters

Also known as baghouses, fabric filters are commonly used in industry to filter particles which flow from the incineration process. Waste gases pass through these permeable bags. Periodically, the bags must be cleaned by shaking them mechanically or by reversing the air flow removing the accumulated particles, which are collected for landfill disposal or recycling.

Cyclones

Cyclones are also commonly used in industry to control particles. Cyclones transform the incoming gas stream into a double vortex. The gas spirals downward in the outer part of the cyclone and upward in the inner part. The particles in the gas stream move to the outer part of the cyclone and spiral downward to an outlet, where they are collected for landfill disposal or recycling.

Gas scrubbers

Gas scrubbers are used to remove the gaseous components and particles of the incinerator emissions. Various wet and dry scrubbing systems are available. A wet or dry chemical agent is used to bond with or react to the gases to form small solid particles. In many cases, acid gases are neutralized. Other gases may be captured. Wet processes usually make it necessary to treat the wastewater before discharge to the sewage system. Dry scrubbers generate a solid waste which requires landfill disposal or recycling.

Electrostatic Precipitators

Electrostatic precipitators send an electric charge between plates that attracts particles in the stack. By themselves, electrostatic precipitators cannot meet current emission standards since their purpose is specifically to remove solid particulate matter in the gas stream.

A state-of-the-art emission control system would consist of a gas scrubber in combination with a fabric filter.

ENVIRONMENTAL PROBLEMS

Air emissions

Even with the newest emission controls, all incinerators release pollutants. The pollutants vary according to the type of garbage burned. They can include nitrogen oxide, sulphur dioxide, hydrogen chloride, metals and organics such as dioxins and furans. Some of these pollutants contribute to global warming; many are toxic. Eventually, they settle in soil and water, adding to the cumulative toxic load on the environment, which can have a detrimental effect on human health.

Very little is currently known about the health risks presented by incineration. Air emission tests usually have been conducted on new facilities operating at peak performance. There is little data available on how incinerators perfomr under the full range of operating conditions. Emissions may also vary considerably over time because of the makeup of the waste stream is not always the same. High concentration of plastics, solvents or other highly volatile materials will result in surges in toxic emissions.

Incinerator solid wastes

Incineration does not make the garbage disappear. The burning process creates bottom ash and fly ash. Bottom ash is the material that doesn't burn and is left at the bottom of the incinerator after all combustible materials are gone. Fly ash is the material trapped by the environmental controls in the stack. These ashes form a substantial amount – 25 to 40 per cent by weight – of the original quantity put into the incinerator. In Ontario, fly ash must be tested and if it is toxic it must be treated or disposed of in a special hazardous waste landfill. Bottom ash need not be tested and can be disposed of in a landfill site. Toxic metals such as mercury, copper, lead, zinc and cadmium have been found in ash. Excess amounts of these toxics can create health problems.

- Mercury damages the central nervous system.
- Copper dust can irritate the nose and upper respiratory tract.
- Lead can cause high blood pressure and nerve damage.
- Zinc dust can cause coughing, fever and muscular aches.
- Cadmium can cause kidney damage. It is known to cause birth defects in animals.

Nuisances

Heavy truck traffic can become concentrated in areas near an incinerator due to the large amount of garbage needed to make the plant viable. Noise and odours from incinerator operations also may be a nuisance for the community.

ECONOMICS OF INCINERATION

Garbage incinerators are expensive to build and operate. A plant handling between 300 and 400 tonnes a day would cost about $50 million to build, and about $65 to $70 a tonne to operate. A plant handling 3,000 tonnes a day would cost about $300 million, and about $40 to $50 a tonne to operate. These operating costs assume successful energy recovery and no down time for repair. In practice, energy recovery can be highly variable and even fully operational incinerators experience at least 15 to 20 per cent down time for repair and other problems.

Several factors contribute to capital and operating costs of incineration facilities.

- Number and size of incinerators, boilers and flue gas cleaning devices
- Trucking of solid waste to the site and ash from the site
- Staffing requirements
- Land and buildings
- Ash disposal (particularly important for toxic fly ash)

Based on per tonne of installed capacity, incinerators cost more to build and operate than landfills; and they cost two to five times more per tonne than a composting plant and up to ten times more per tonne than a material recovery facility.

COMPATIBILITY WITH THE 3RS

Incineration is not compatible with the Ministry of the Environment's waste management strategy that encourages Ontario's citizens to adopt the principles of a "conserver society." Through policies and programs based on the 3Rs (reduce, reuse and recycle), the ministry promotes widescale waste diversion from disposal in the province's residential, industrial, commercial and institutional sectors. With these programs, the Ontario government expects to meet its waste reduction targets of 25 per cent in 1992 and 50 per cent by the year 2000. Incineration is not compatible with this strategy for a number of reasons:

- Instead of reducing waste production, incineration demands a constant supply of garbage to be economically viable. For large incinerators, 3,000 tonnes per day are needed to make the plant profitable, even if it means shipping garbage in from other places.

Recycling and incineration compete for the same materials in the waste stream. The recycling of materials such as paper and wood may mean that the remaining waste stream has insufficient heating value to support incineration.

- Some of the incinerated wastes includes valuable materials that could be recycled. This in turn, hurts the economic viability of recycling programs, such as the Blue Box.

- The large amount of money that is spent to build and operate incinerators takes away financial resources that could be put towards the more environmentally sound approach of 3Rs programs.

- Incineration removes incentives for manufacturers to reduce excess packaging and to make products which are reusable and recyclable.

- Even when incinerators produce energy as a by-product, this is a very inefficient process. More energy can be saved by recycling materials than by burning them. Solid waste is not a very good fuel, partly because it is often too wet and because of extreme variations in composition.

- The disposal of hazardous fly ash in landfills contributes to the stockpile of toxic wastes which already exists and degrades our environment.

- Incineration competes with the development of new environmentally responsible "green" technologies and materials.

GARBAGE INCINERATION BAN IN ONTARIO

In April 1991, Ontario Minister of the Environment, Ruth Grier, announced a ban on the construction of new garbage incinerators in Ontario. The ban does not affect the province's five existing garbage incinerators and one approved facility near completion. However, the Ministry of the Environment is reviewing the Certificates of Approvals and monitoring requirements for these facilities. The incineration of biomedical waste, wood and hazardous waste, as well as the burning of untreated wood continues to be permitted but is being reviewed as a disposal option.

For more information on waste issues contact:

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